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Estimation of microbial air contamination of livestock farms and hospitals in veterinary college Bidar, India

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Abstract
In the present study the level of microbial air quality of farm and hospital was analyzed in veterinary College, Bidar, Karnataka by settle plate method. Air samples were collected separately for bacteria(b) and fungi(f) from livestock farm (n=12(b) and 14(f)), chicken hatcheries (n=09(b) and 11(f)), veterinary clinical complex(n=14(b) and 12(f)), veterinary hospitals (n=08(b) and 11(f)), and laboratories(n=17(b) and 14(f)) were collected in petri plates using Nutrient agar for bacteria and Malt extract agar for fungus. A total of 122 air samples were taken, on regular basis, the growth was identified by standard microbiological procedure which include incubation of petri plates at 37 °C for 24-48 hours for bacteria and incubation of agar plates at 25 °C for 7 days for fungus. Out of 122 samples taken from livestock farms, hatcheries, veterinary clinical complex, veterinary hospitals, and laboratories 4(33.33%), 3(33.33%), 7(50%), 4 (50%) and 4(23.52%) samples were found positive for bacteria and 5(35.71%), 2(18.18%), 9(75.00%), 3(27.27%) and 7(50%) samples were found positive for fungus respectively. In this study Bacteria like *Staphylococcus spp*, *Pseudomonas spp* and fungus like *Aspergillus spp* were isolated using standard microbiological procedure. To conclude air borne bacteria and fungus are present in the area under investigation and it is necessary to prevent the occurrence of such microbes by taking proper prevention steps.

Keywords: Microbial air, settle plates, monitoring, livestock farm, hospital

Introduction
The microbial air contamination of environment is considered to be a mirror image of hygienic condition of any place especially veterinary farms and hospitals. The level of microbial air contamination in place at risk is considered to be a basic step towards prevention of potent air borne infection according to Sabharwal and Sharma (2015) [7]. The concentration of the microorganism in the atmosphere gives clear idea about its level of environmental contamination and because of this polluted atmosphere can have direct effect on human and animal health survival. Microbial air contamination at veterinary hospital is a major risk factor for nosocomial infection. Air-bio load present in the form of bio-aerosol which contain bacteria, virus, yeast, mould and fungal spore by Kasdekar *et al.* (2016) [2]. These microorganisms may be harmful when present in higher concentration in the atmosphere. Several sources are found to be responsible for emission of these bioaerosol in the atmosphere. These include natural sources such as soil, water, plants, animals, and human as well as anthropogenic like agricultural practices, healthcare units and industrial operations Naruka *et al.* (2014) [4]. Environmental monitoring includes the microbial testing of air, surface, equipment, feed and water to know about the load of bacteria at respective location. It predicts the likely contamination rate at particular site as it allows a direct means of the number of organism settling on the surface.

Air sampling of livestock farms and hospital gives idea about the sterility condition of respective location by Naik *et al.* (2018) [3]. Air borne transmission occurs when pathogenic microorganism transferred from infected patient to the susceptible one via. The air. Among all possible sources outdoor air was considered to be the most important source of indoor micro-floura. Daily exposure to air borne bacteria and fungus is responsible to cause potential biological hazard and have been associated with adverse health effect. Control of air borne pathogen at livestock farms and hospital is important for the safety of the workers, laborers, and patient by Naruka *et al.* (2014) [4] recently, there Had been a tremendous increase in resistant microorganism which causes specially livestock farm and hospital infection so our

duty as veterinary microbiologist to increase awareness programme to prevent and control air borne diseases and also increase awareness about the microbial air quality and its impact on human health. The objective of the study was to determine the bacterial and fungal load in livestock farm and veterinary hospital at veterinary collge Bidar, Karnataka.

Materials and methods

The study was carried out in Department of Veterinary public health and epidemiology, veterinary College Bidar, Karnataka.

In the present study passive air sampling was performed using settle plates method. Petri dishes containing solid nutrient agar for bacterial and malt extract agar for fungal load examination were left open in the air for a given period of time. Microbes carried by inert particles fall onto the surface of the agar under the force of gravitation. The settle plate method is still widely used as a simple, easy, economical, less expensive way to qualitatively assess the environments over prolonged exposure times. Use of settle plate can provide an idea about the environment load with airborne microorganisms by Srikant *et al.* (2008) [8].

Table 1: Sample collection

Place	Sample collected	
	Bacterial	**Fungus**
Livestock Farm	12	14
Hatcheries	9	11
Veterinary Clinical Complex	14	12
Veterinary Hospitals	8	11
Laboratories	17	14
Total	60	62

Nutrient agar for bacteria and Malt extract agar for fungus plates were used after sterility testing. The plates were transported to collection site. The plates were labelled with bacteria (b) and fungus (f) area of sampling, time and date of sample collection. Total numbers of 122 settle plate's i.e.60 for bacterial and 62 for fungal samples were collected (Table 1). During air sampling sterile gloves, mouth mask and protective gown were worn to prevent self-contamination of the nutrient and malt extract agar plates.

The procedure involved keeping of petri plates open in the area under investigation according to the standard 1/1/1/ scheme *i.e* for 1hr/1m above the floor /at least 1m away from wall of any obstacle given by Sabharwal and Sharma (2015) [7]. After this exposure, the plates were covered with their lids and immediately taken to Department of veterinary public health and epidemiology laboratory in sealed plastic bags, taking all aseptic precautions. The growth was identified by standard microbiological procedures which include incubation of petri plates at 37 °C for 24-48 hours for bacteria and incubation of agar plates at 25 °C for 7 days for fungus.

The culture plates of bacterial and fungal both showed discrete macroscopic colonies were counted using digital colony counter. The colonies were assessed for the growth of potential pathogenic bacteria initially by colony characteristics, and microscopic examination of Gram stained smears. Identification was done by using standard bacteriological techniques according to Vandepitte *et al.* (2003) [9]. Final identification was done following standard bacteriological techniques. The concentration of airborne bacteria was expressed as colony forming units per cubic meter (cfu/m3). Settle plate showing fungus was also noted. Lactophenol Cotton Blue staining was done to characterize structure of fungus followed by its identification.

Results and Discussion

A total of 122 samples i.e. 60 (b) & 62 (f) taken repeatedly from five different location. The isolates were positive for *Staphylococcus spp*, *Pseudomonas spp* and fungus like *Aspergillus spp*. using standard microbiological procedure. The microbiological quality of air can indeed be considered as a picture of the hygienic condition of hospitals and farms.

A total 122 plates were studied, out of which 22 (b) and 26(f) sample were reported as unsatisfactory by Naik *et al*. (2018) [3]. All these 22(b) plates were showing growth of *Staphylococcus spp* (Figure 3) which is in concordance with the studies of Sabharwal and Sharma (2015) [7], Kasdekar *et al.* (2016) [2] and Naik *et al.*(2018) [3] as well as *pseudomonas spp*. These 22(b) unsatisfactory settle plates were from livestock farms 4(33.33%), hatcheries 3(33.33%), veterinary clinical complex 7(50%), veterinary hospitals 4 (50%), and laboratories 4(23.52%) respectively. (Table 2). For fungus, all 26(f) plates were showing growth of *Aspergillus spp*.(Figure 1 & 2) These 26(f) unsatisfactory settle plates were from livestock farms, hatcheries, veterinary clinical complex, veterinary hospitals, and laboratories 5(35.71%), 2(18.18%), 9(75.00%), 3(27.27%) and 7(50%) respectively. The microbiological quality of air in Veterinary hospitals, livestock farm, hatchery, and laboratory depends on the infection control practices, managemental procedure, type of organism studied in the laboratory. In our study out of 122 settle plates 22(b) and 26(f) were found to be unsatisfactory, which indicates unhygienic environmental.(Figure 4) Different studies showed higher concentrations of cocci due to lower susceptibility of organisms to environmental stress due to the presence of pigments and higher peptidoglycan in their cell wall preventing them from drying and heat stress Raymond *et al*. (2001) [6].

Airborne transmission occurs when pathogenic microorganisms are transferred from an infected to a susceptible individual via the air. Another source of microorganisms in the veterinary hospital and livestock farms are occupants of the building i.e. hospital personnel and visitors. Amount of materials brought from outside such as personal belongings, food and fruits are recognized as source of contamination.

Various studies suggest that the distribution of microorganisms in the air, varies among geographic areas and is also influenced by seasonal environmental and climatic factors such as temperature, humidity, time and wind speed. Variation and fluctuation of the environmental observed during the study. Kind of hospital and shed arrangement along with the type of room, animal house and the time of sampling is a significant factor that influences the rate of indoor air microorganisms. Among all possible sources, outdoor air is thought to be the most important source of indoor micro flora. Many studies have reported the role of outdoor microbial concentration through opened windows and doors in raising the microbial rates and homogenization of indoor air of building.

Table 2: Shows Total Numbers of Settle Plates Showing Positivity in livestock farm and hospital

Sample Collected/Area	Number of settle plate observed		Settle plate showing positive result		Percentage of positivity	
	Bacteria	Fungus	Bacteria	Fungus	Bacteria	Fungus
Livestock Farm	12	14	4	5	33.33	35.71
Hatcheries	9	11	3	2	33.33	18.18
Veterinary Clinical Complex	14	12	7	9	50	75
Veterinary Hospitals	8	11	4	3	50	27.27
Laboratories	17	14	4	7	23.52	50
Total	60	62	22	26	-	-

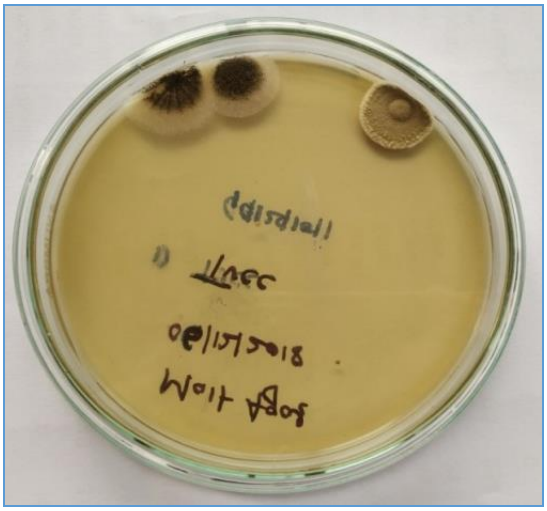

Fig 1: *Aspergillus spp* TVCC

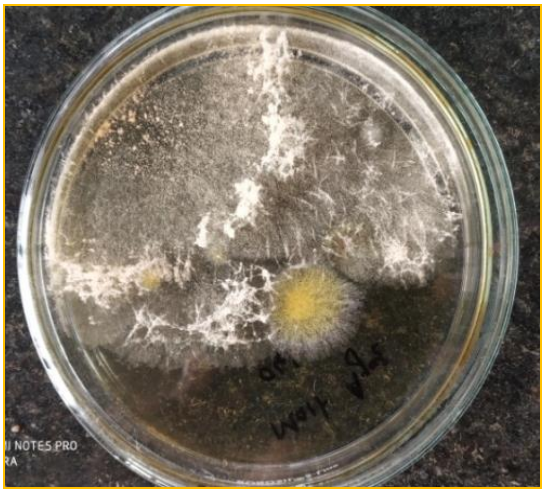

Fig 2: *Aspergillus spp.* Hatcheries

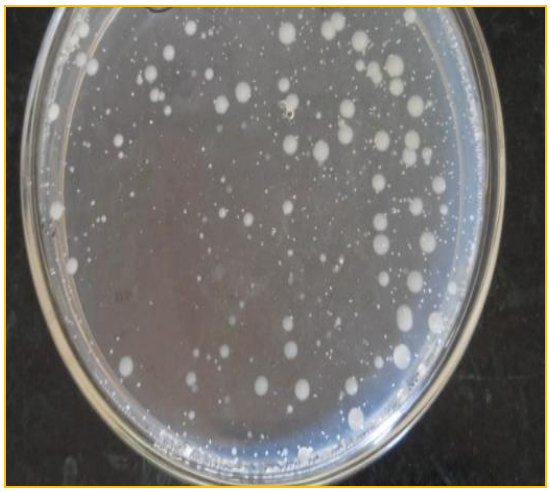

Fig 3: *Staphylococcus spp* from Livestock Farm

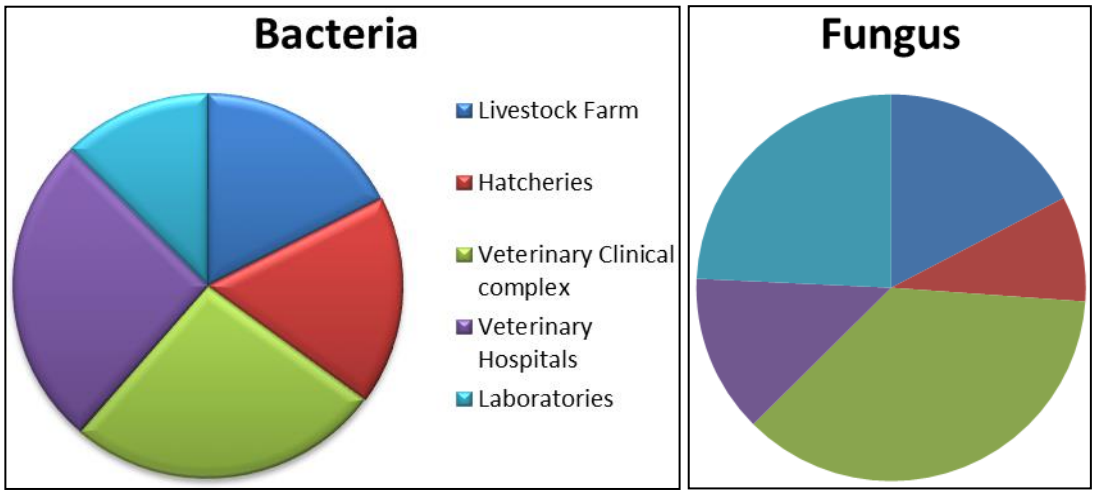

Fig 4: Graphical distribution of bacteria and fungus from respective location

In conclusion**,** it is the responsibility of the veterinary microbiologist or public health veterinarian to keep a regular check on the level of microbial air contamination. Most of the microbes in hospital and farms because of the air fare from staff and a few are from the infected animals, and few are from the unhygienic practices. Appropriate managemental practices can minimize the spread of bacteria and fungus and reduce airborne microbial contamination. Harboring of potential pathogens in hospital and farms can pose a great risk to patients, owners, workers, veterinary doctors. Monitoring the bioaerosol load or air contamination helps in assessing the capability of air filters used in the hospitals and farms also helps in assessing quality and making timely changes in measures that need to be adopted.

There are no universal guidelines about the concept of regular monitoring and sampling. But till the time we have know about Standard Operating Procedures and guidelines, and do continuous surveillance by the infection control teams to provide a safe environment for workers in farms as well as for the hospital patient and prevent nosocomial infection. Air quality of hospital and farms is important and cannot be neglected in reference to hospital and farm acquired infections.

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